

I (WE) CLAIM:

1. A method for automatic optimization in spectral Doppler ultrasound imaging, the method comprising:
  - (a) firing at least first and second sequences of spectral Doppler pulses;
  - (b) determining at least first and second goal values in response to the first and second sequences, respectively;
  - (c) estimating a change of a spectral Doppler parameter as a function of the first and second goal values; and
  - (d) automatically setting the optimal spectral Doppler parameter as a function of the estimated change.
2. The method of Claim 1 wherein (c) comprises estimating the change of the spectral Doppler parameter selected from the group of: transmit frequency, gate position, filter setting, Doppler gain, angle of scan line for a gate position and combinations thereof and (d) comprises automatically setting the spectral Doppler parameter selected from the group above for (c).
3. The method of Claim 2 wherein (c) comprises estimating the change of the gate position and wherein (d) comprises automatically setting the gate position.
4. The method of Claim 2 wherein (c) comprises estimating the change of the Doppler gain and wherein (d) comprises automatically setting the Doppler gain.
5. The method of Claim 2 wherein (c) comprises estimating the change of the filter setting and wherein (d) comprises automatically setting the filter setting.
6. The method of Claim 1 wherein (b), (c) and (d) comprise numerically optimizing the spectral Doppler parameter without full sampling of a one or higher dimensional region.

7. The method of Claim 1 further comprising:
  - (e) generating a spectral Doppler display in response to the spectral Doppler parameter set in act (d).
8. The method of Claim 1 wherein (c) comprises estimating a vector corresponding to two different spectral Doppler parameters and (d) comprises setting both spectral Doppler parameters as a function of the vector.
9. The method of Claim 1 wherein (a) comprises transmitting the first sequence in response to a first setting of the spectral Doppler parameter and transmitting the second sequence in response to a second setting of the spectral Doppler parameter, the first setting different than the second setting, and (d) comprises automatically setting the spectral Doppler parameter at a third setting the same or different than one or both of the first and second settings.
10. The method of Claim 1 wherein (b) comprises determining the first and second goal values as spectral intensity sums.
11. The method of Claim 1 wherein (b) comprises determining the first and second goal values as spectral signal-to-noise sums.
12. The method of Claim 1 wherein (b) comprises determining each of the first and second goal values over at least a one heart cycle period, the first goal value corresponding to a different heart cycle than the second goal value.
13. A method for automatic optimization in spectral Doppler ultrasound imaging, the method comprising:
  - (a) receiving an initial spectral Doppler parameter value;
  - (b) automatically altering the initial spectral Doppler parameter value to a second spectral Doppler parameter value;

(c) determining a third spectral Doppler parameter value as a function of a numerical optimization of the initial and second spectral Doppler parameter values.

14. The method of Claim 13 wherein (a) comprises receiving the initial spectral Doppler parameter value as a user selected setting.

15. The method of Claim 13 wherein the initial, second and third spectral Doppler parameter values are selected as a type of value from the group of: transmit frequency, gate position, filter setting, Doppler gain, angle of scan line for a gate position and combinations thereof.

16. The method of Claim 13 wherein (c) comprises determining a gradient as a function of the initial and second spectral Doppler parameter values and determining the third spectral Doppler parameter as a function of the gradient.

17. The method of Claim 13 wherein (a) through (c) comprises estimating a vector corresponding to two different types of spectral Doppler parameters and setting both types of spectral Doppler parameters as a function of a numerical optimization of the vector.

18. The method of Claim 13 further comprising:

(d) calculating a first resultant goal value in response to the initial spectral Doppler parameter value;

(e) calculating a second resultant goal value in response to the second spectral Doppler parameter value;

wherein the first and second resultant goal values are selected from the group of: spectral intensity sums, spectral signal-to-noise sums, spectral maximum velocity and combinations thereof; and

wherein (c) comprises numerically optimizing as a function of the first and second resultant goal values.

19. A method for automatic optimization in spectral Doppler ultrasound imaging, the method comprising:

- (a) firing at least one Doppler pulse into an identified region; and
- (b) automatically setting at least one of: transmit frequency, filter settings and Doppler gain in response to an echo signal from (a).

20. The method of Claim 19 further comprising:

- (c) estimating a first setting from previous settings;
- wherein (b) comprises automatically setting as a function of the estimated first setting.

21. A system for automatic optimization in spectral Doppler ultrasound imaging, the system comprising:

a transducer operative to fire at least first and second sequences of spectral Doppler pulses; and

a processor operative to determine at least first and second values in response to the first and second sequences, respectively, estimate a change of a spectral Doppler parameter as a function of the first and second values, and automatically set the spectral Doppler parameter as a function of the estimated change.

22. The system of Claim 21 wherein the processor is operative to estimate the change by adaptively generating zero or more of iterations of acts which include one or more of: generating intermediate spectral Doppler parameter setting based on the preceding calculated values, to instruct the transducer to fire the corresponding sequence of spectral Doppler pulses and compute the intermediate goal value, and to automatically set the optimal spectral Doppler parameter value based on the preceding calculated values.

23. The method of Claim 1 wherein (c) comprises adaptively performing zero or more iterations of the following acts based on the first and second goal values;

(c1) generating an intermediate spectral Doppler parameter setting based on previous calculated goal values;

(c2) firing a sequence corresponding to the intermediate spectral Doppler parameter; and

(c3) calculating a third goal value in response to the sequence; and

wherein (d) comprises automatically setting the optimal spectral Doppler parameter based on the preceding calculated goal values.

24. The method of Claim 13 wherein (c) comprises adaptively and iteratively generating zero or more intermediate spectral Doppler parameter values.

25. A method for automatic optimization in spectral Doppler ultrasound imaging, the method comprising:

- (a) firing at least first and second sequences of spectral Doppler pulses;
- (b) determining at least first and second goal values in response to the first and second sequences, respectively;
- (c) adaptively performing zero or more iterations of the following acts based on the first and second goal values;
  - (c1) generating an intermediate spectral Doppler parameter setting based on previous calculated goal values;
  - (c2) firing a sequence corresponding to the intermediate spectral Doppler parameter; and
  - (c3) calculating a third goal value in response to the sequence;
- and
- (d) automatically setting an optimal spectral Doppler parameter based on the preceding calculated goal values.